Assessment of thunderstorm-induced asthma using Google Trends

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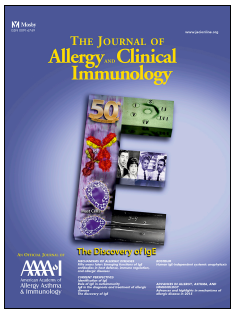

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Assessment of thunderstorm-induced asthma using Google Trends

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Short title: Google Trends in asthma

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Capsule summary

An asthma outbreak of hospitalizations and deaths was noticed in Australia (November 2016) and in Kuwait (December 2016). This outbreak was clearly demonstrated using Google Trends (GT), a Web-based surveillance tool of interest in clinical practice.

Key words: Allergy, Asthma, Google Trends, Pollen, Rhinitis, Thunderstorm

Abbreviations

GT: Google Trends
EU: European Union
UK: United Kingdom
USA: United States of America

Word count: 1012

To the editor

Google Trends (GT), a Web-based surveillance tool, uses Google to explore the searching trends of specific queries. GT may predict the outbreak of many diseases. In Germany, correlations between the patient-based, combined symptom medication score and GT data are stronger than those with the regionally-measured pollen count data [1]. Search activities using GT for terms such as "allergy," "allergies," and "pollen" correlate strongly with observed pollen counts [2,3]. GT reflects the real-world epidemiology of symptomatic allergic rhinitis and could potentially be used to monitor allergic rhinitis[4]. Seasonality of allergic rhinitis was found using Internet searches and correlated with pollen counts [3]. Twitter data, Google search interests, and environmental sensor data can also be used to predict the number of asthma-related emergency department visits in an area [5].

Studies on thunderstorm-induced asthma have convincingly shown that grass pollen can induce severe asthma exacerbations when climatic conditions and pollen exposure are associated [6,7]. It is possible that such outbreaks can be observed using GT. Two recent outbreaks with several asthma deaths were observed in Melbourne, Australia, November 20, 2016 and in Kuwait, December 2, 2016.

In the present study, we used GT to compare terms related to asthma, allergy and rhinitis in 10 countries from 2004 to December 20, 2016. The aims of the study were (i) to assess whether GT could report the recent thunderstorm asthma outbreak in Australia and Kuwait; (ii) to determine whether such an outbreak could be found in other countries over the past 13 years.

Methods

The following terms were used: “rhinitis”, “allergic rhinitis”, “hay fever”, “asthma”, “pollen”, “allergy” (disease and term). However, only “allergy”, “allergic rhinitis”, “asthma” and “pollen” were analyzed since “rhinitis” as a term or “hay fever” were labeled as “allergic rhinitis disease”. Only “diseases” and “subjects” are translated by GT whereas “terms” are not translated. Major anti-rhinitis (e.g. Loratadine, Cetirizine) or anti-asthma (e.g. Salbutamol, Seretide) medications were studied. Intra-nasal and inhaled corticosteroids could not be differentiated using GT and were not used in the study.

We examined GT queries from January 1, 2004 (starting date of GT) to December 20, 2016 for “all countries” and from January 2011 to December 20, 2016 for the five most populated European Union (EU) countries (i.e. France, Germany, Italy, Spain, United Kingdom (UK)), as well as Australia, Canada, New Zealand and the USA. Only temperate and continental climatic zone countries were studied, as allergen exposure may vary with other climatic zones. We added Kuwait, as a severe thunderstorm-induced asthma outbreak occurred December 2, 2016.

The prediction of the asthma outbreak using “allergic rhinitis”, “allergy”, “pollen” or “rhinitis medications” queries was not tested since a more detailed analysis should be carried out focusing on the region of the thunderstorm.

Results

When the trends for “all countries” were analyzed over the 13-year survey, the yearly trends were comparable for the four terms between years (Figure 1 online). Trends for “allergy” were far higher than for the other terms. Peaks were identified for “allergy” and “hay fever” but there was no clear trend for asthma. Seasonal trends were observed for “Cetirizine”, “Loratadine” and “Fexofenadine”

from 2008 to 2016 (Figure 2 online). On the other hand, there was no seasonality trend for asthma linked with “allergy”, “pollen” or “allergic rhinitis” terms or for anti-asthma medications.

When the trends for the different countries were analyzed, GT was able to clearly demonstrate a sharp and extremely important increase of “asthma” queries in Australia (Figures 1A and 1B) and Kuwait (Figures 2A and 2B). The peak of queries started on the day of the asthma outbreak and asthma queries returned to baseline within three weeks. There was no association between “asthma” and “asthma medication” queries.

The examination of trends from 2004 to 2016 showed no other apparent peak of asthma queries using GT from 2004 to December 20, 2016 in the eight other countries selected (Figure 3 online). However, the analysis of the 5-year period (2011-2016) showed two peaks of asthma queries, one associated with “allergic rhinitis”, “pollen” and/or “allergy” in New Zealand (November 2016) and a second apparently independent (Figure 4 online). The thunderstorm asthma outbreaks that occurred in Italy in 2004 and 2010, and in Australia in 2010 could not be identified using the country trends (13-, 5- and 1- year graphs).

Trends for asthma outbreaks were of similar importance to those for flu outbreaks in Australia and Kuwait (Figure 5 online).

Discussion

Seasonality can be found using 13- and 5-year GT graphs for “allergy”, “hay fever”, “pollen” and H_1-antihistamines. Some seasonality may be observed for asthma but it is independent of “allergy” or “hay fever”. Asthma outbreaks can be clearly identified.

This study cannot avoid the possible misclassification of asthma, allergy and rhinitis, and reporting of the terms differs between countries. The 5-year queries regarding “hay fever” and “pollen” differed between countries and there may be country-specific queries. However, the same seasonal trends exist for “allergy”, “hay fever”, “pollen” and “rhinitis medications”.

The 2016 Australia and Kuwait asthma outbreaks were clearly demonstrated using GT. Such a pattern was also possibly found in New Zealand. The thunderstorm asthma outbreaks that occurred in Italy in 2004 and 2010, and in Australia in 2010 could not be identified, probably because of the small number of affected people. The asthma outbreak was at least more visible than flu.

Significant spikes in the Google search can be found with increased awareness of a disease by news media and marketing media [8]. In Europe, late December 2016, spikes for “allergy”, “asthma”, “pollen” or “allergic rhinitis” were associated with the awareness of thunderstorm asthma in Australia and Kuwait [9].

There is no correlation between “rhinitis” or “pollen” and “asthma” in any of the surveyed countries except for the 2016 November asthma outbreak of Australia and possibly for one year in New Zealand. On the other hand, the asthma outbreak of Kuwait appeared to be independent of “allergy”, “hay fever” or “pollen”. This study shows that seasonal asthma can be identified by GT when there is a severe asthma outbreak, but is not reported elsewhere. However, more precise analyses are needed to investigate subtle trends.

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1 **Figure 1: Queries reported by Google Trends in Australia**

2 **A: 5-year trend: January 1, 2004-December 20, 2016**

3 **B: 90-day trend: September 24-December 20, 2016**

4

5 **Figure 2: Queries reported by Google Trends in Kuwait**

6 **A: 5-year trend: January 1, 2004-December 20, 2016**

7 **B: 90-day trend: September 24-December 20, 2016**

Figure 1 online: Queries reported by Google Trends in all countries (January 1, 2004 - December 20, 2016)

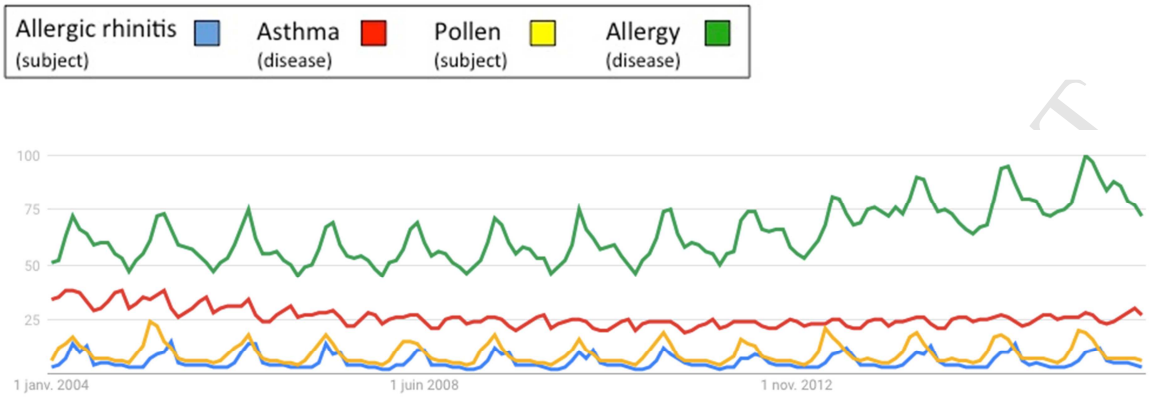


Figure 1A: Queries reported by Google Trends in Australia (January 1, 2004-December 20, 2016)

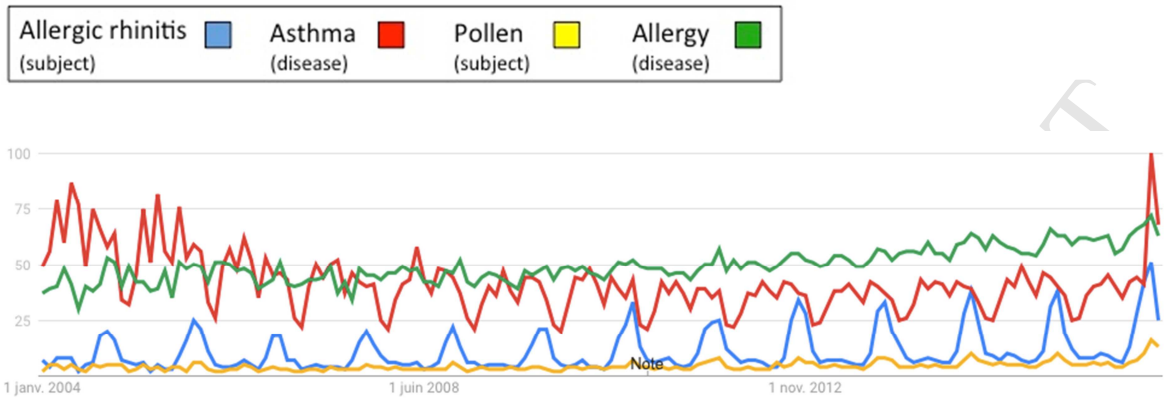


Figure 1B: Queries reported by Google Trends in Australia (September 24-December 20, 2016)

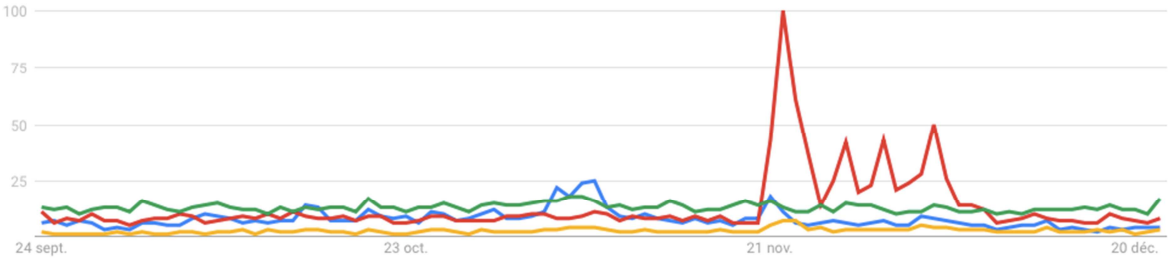
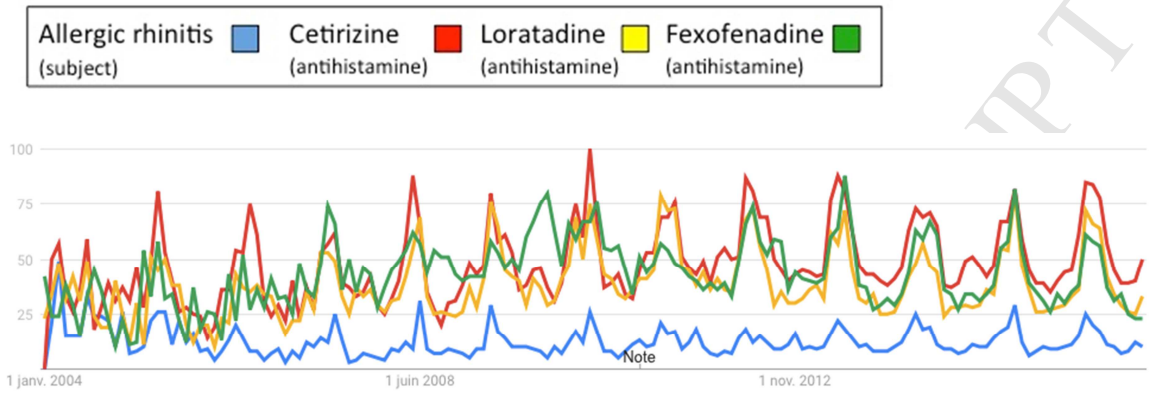


Figure 2 online: Google Trends for medication in all countries (January 1, 2004 – December 20, 2016)

A- Antihistamines



B- Anti-asthma medications

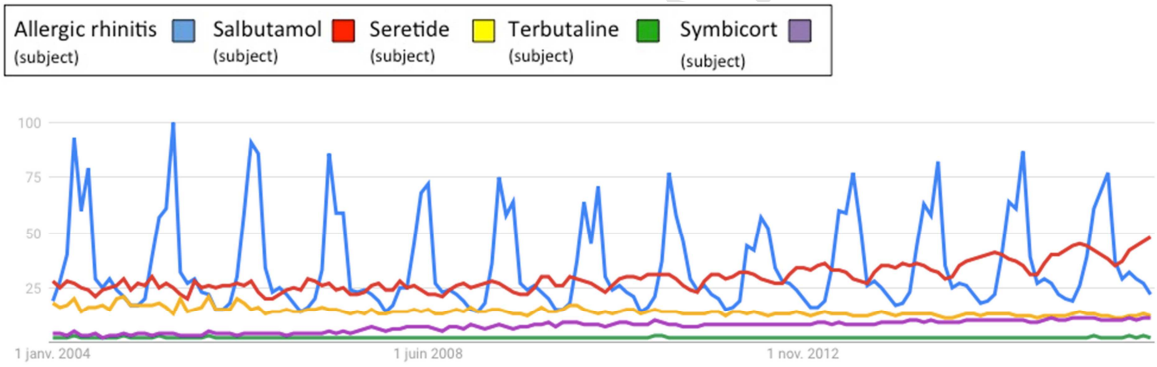


Figure 2A: Queries reported by Google Trends in Kuwait (January 1, 2004-December 20, 2016)

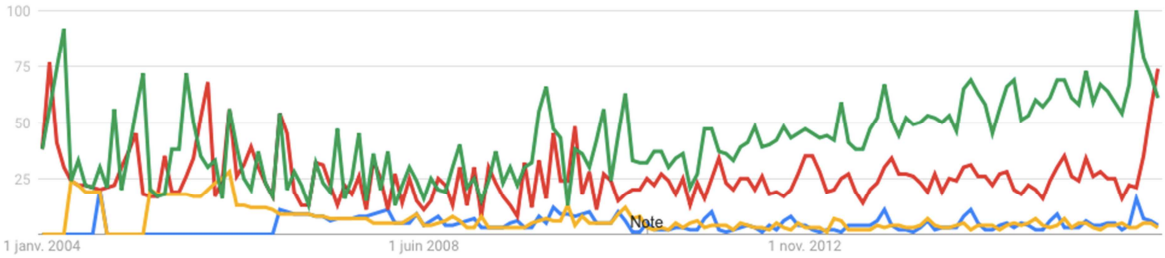


Figure 2B: Queries reported by Google Trends in Kuwait (September 24-December 20, 2016)

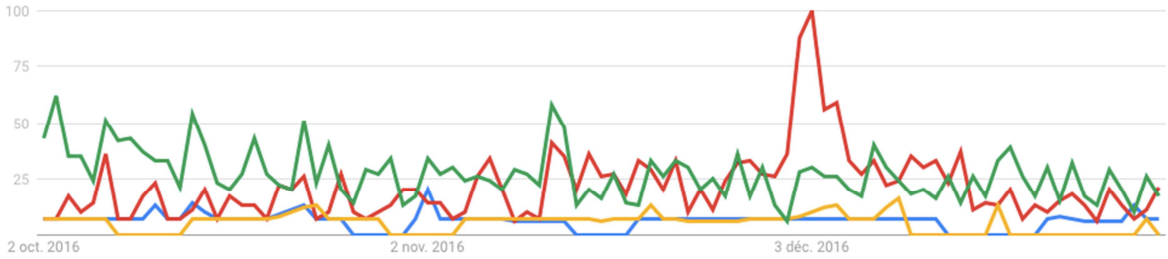
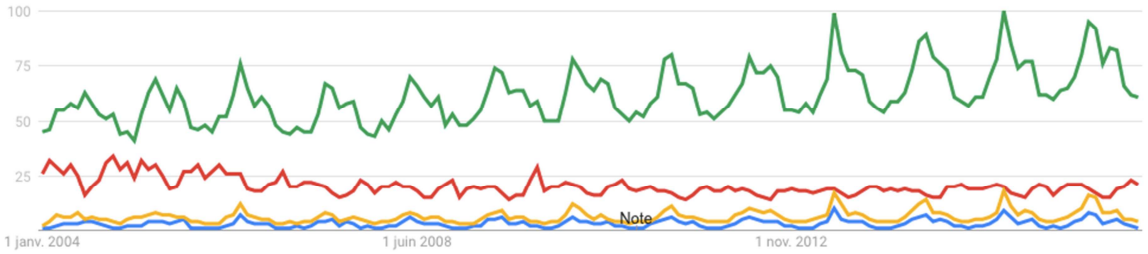
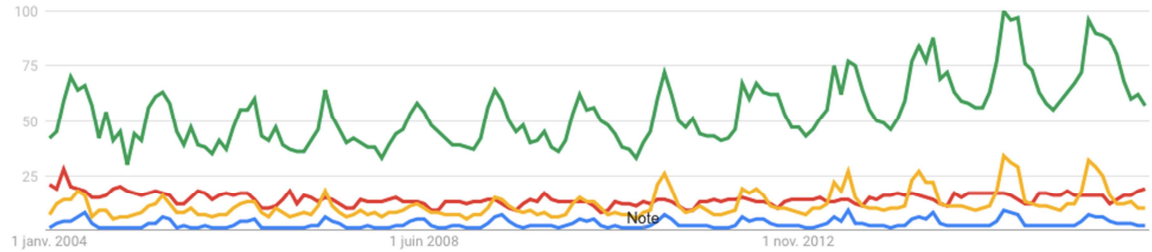


Figure 3 online: Google searches (January 1, 2004 - 20 December 2016)

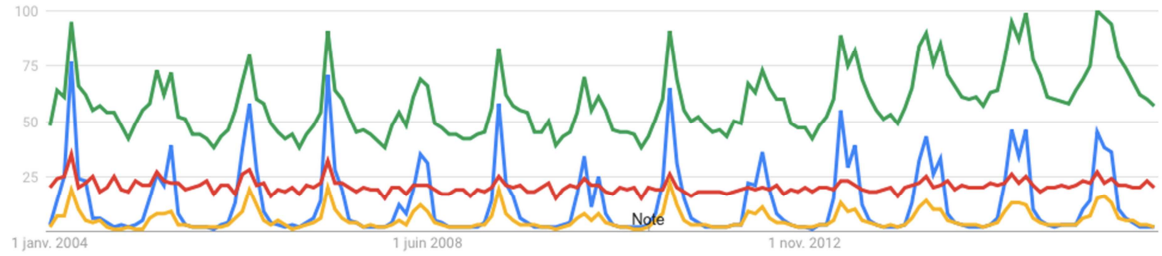
A- Canada



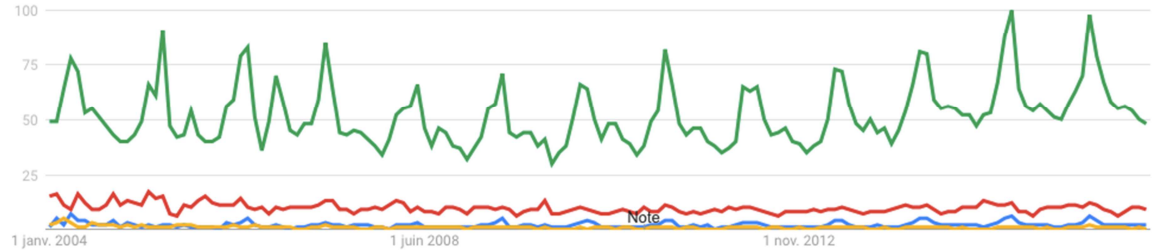
B- France



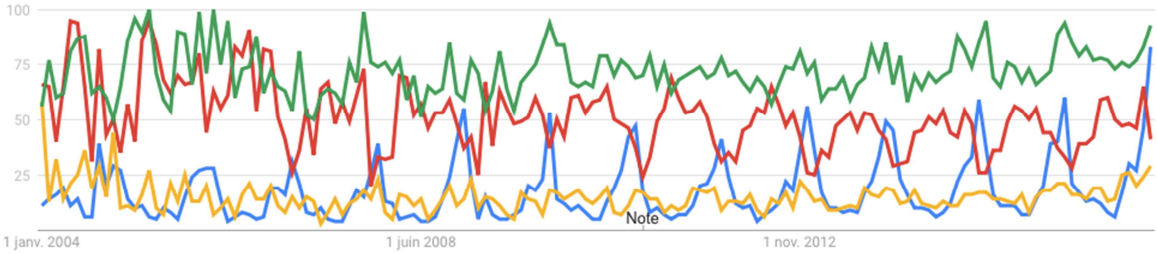
C- Germany



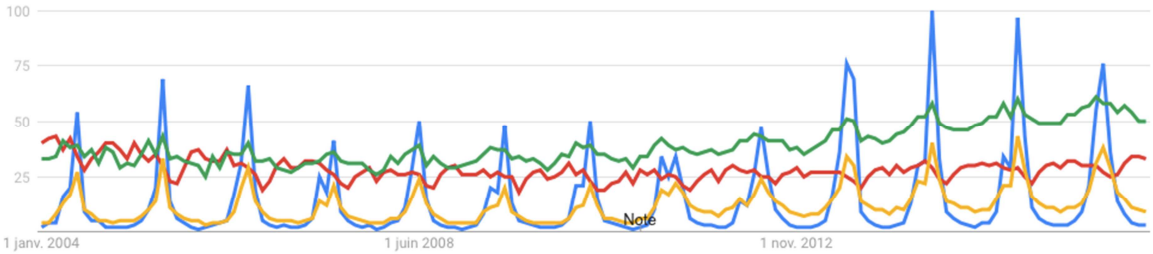
D- Italy



E- New Zealand



F- UK



G- USA

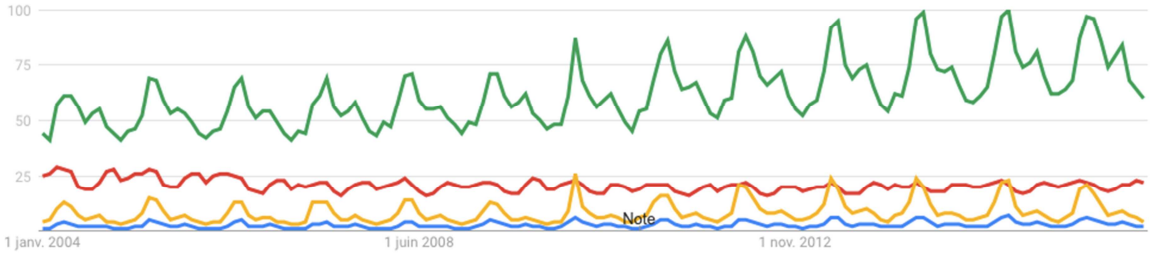
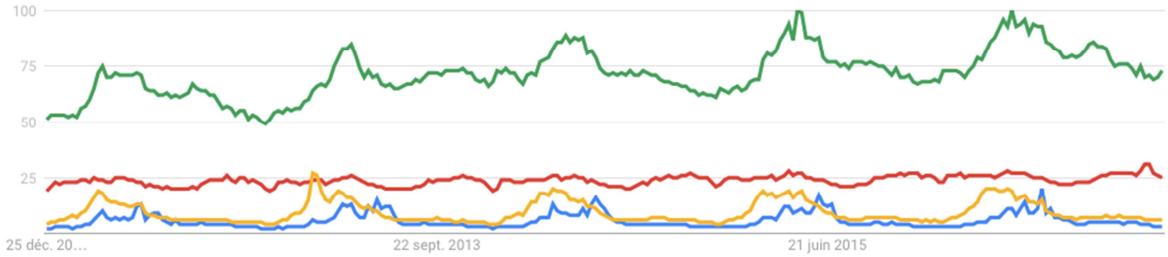
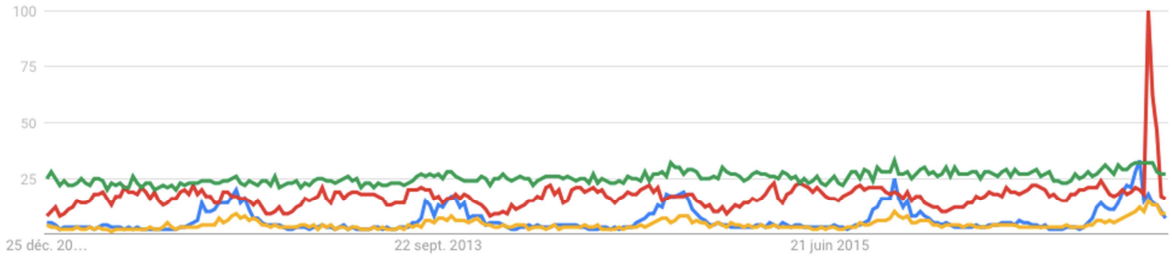


Figure 4 online: Google searches (December 25, 2011 – December 20, 2016)

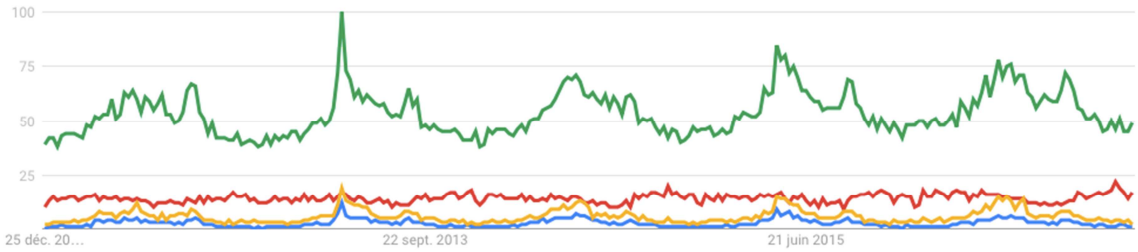
All countries



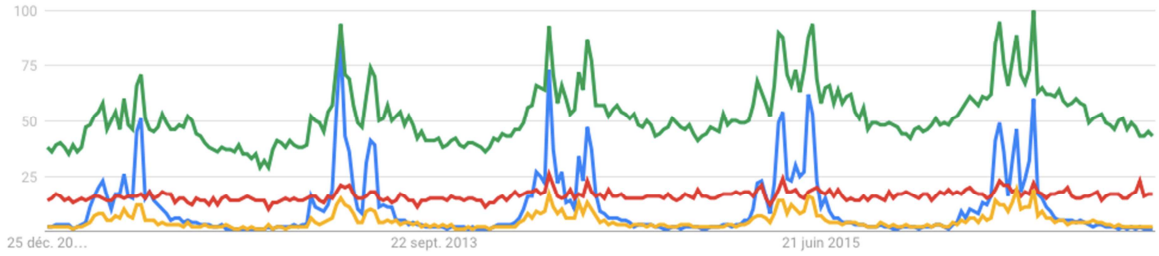
A- Australia



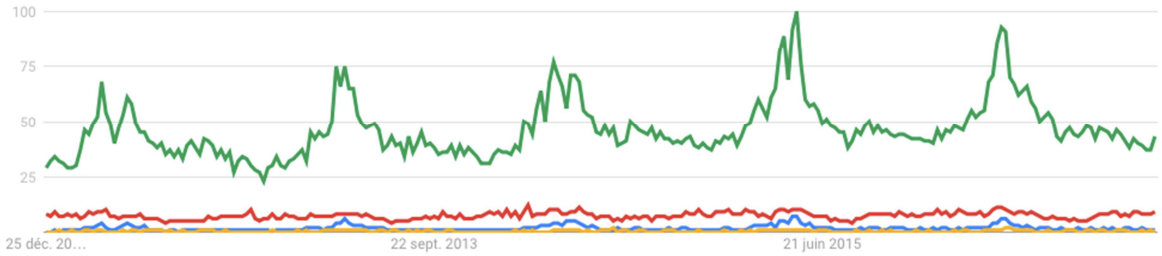
B- Canada



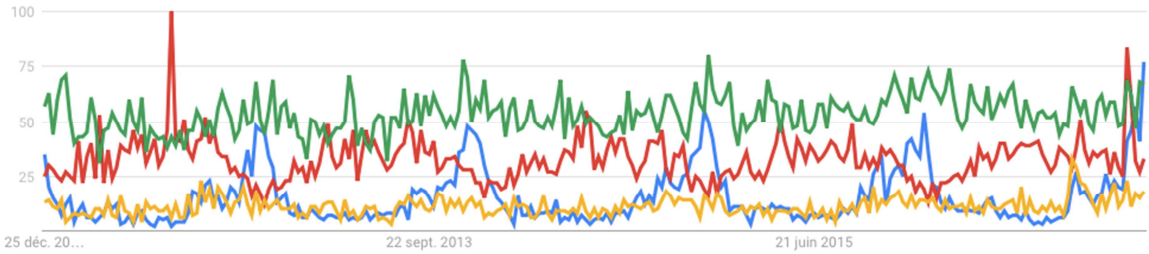
C- Germany



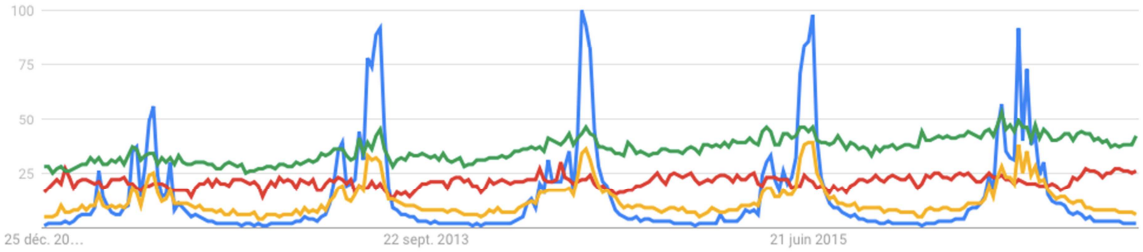
D-Italy



E- New Zealand



F- UK



G- USA

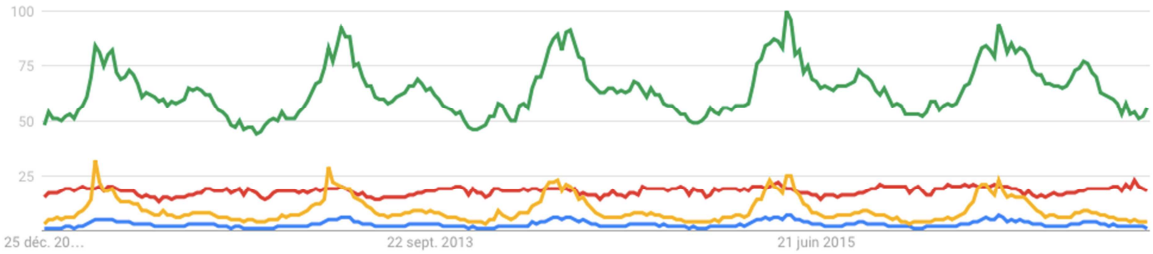
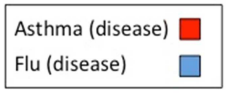
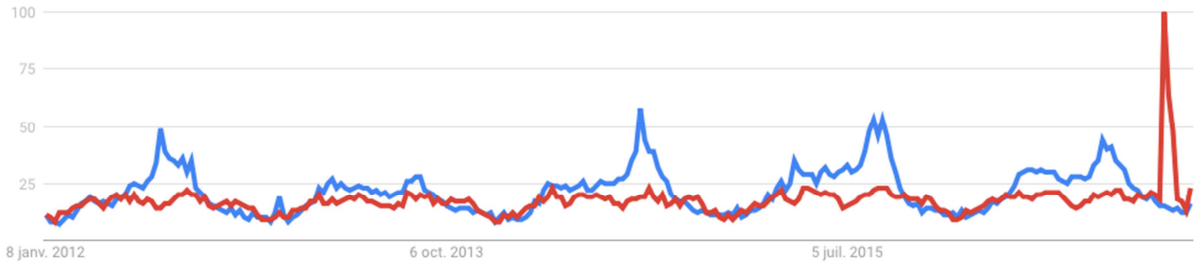


Figure 5 online: Google searches (January 4, 2012 – December 27, 2016)



Australia



Kuwait